**Thermal Design**

Since none of the components in the converter are ideal, all of them dissipate certain amount of heat. It is essential to calculate heat dissipation of these components and provide cooling in order to achieve a stable operating temperature without harming any of the components.

In this forward converter design, only the heating of semiconductors (MOSFET and diodes) will be considered since they are the main source of heating. Rest of the components are assumed to dissipate the heat without any cooling. For equations in this part, mainly Infineon Forward Converter Design Note [x] was used. Lowest value of 24V for input voltage was chosen, as well as rated output power, which are the worst cases for the thermal design.

1. MOSFET:

MOSFET has conduction losses when it is on, which is calculated with the equation x. IDS is the average current passing through MOSFET, which was found from simulations. RDS=0.18Ω from the datasheet.

(x)

For Vi=24V and D=0.467

IDS=2.74A and PC=1.351 W

Secondly, MOSFET also has switching losses.

Switching losses are found using equations (x) and (x) where ton and toff are given in the datasheet. Assuming average voltage and current during those intervals as half of their DC values, total switching losses can be approximated.

(x)

Similarly, for turn off period,

(x)

Therefore, total power dissipation of MOSFET is

PMOSFET =1.555W

Using Lamped Parameter Model, required heatsink thermal resistivity can be found using formula (x).

(2)

Maximum operation junction temperature of MOSFET is given as 150 °C, for the design, junction temperature will be chosen as 120 °C. Ambient temperature is assumed to be 30 °C. Junction to case thermal resistivity of the MOSFET is given as 3.13 °C/W in the datasheet. Substituting these values, required heatsink thermal resistivity can be calculated as

54.75 °C/W

Also, package type should be same with the MOSFET, which is TO-220 package.

Selected heatsink:

V5629G

Rth=40.00°C/W

TO-220F package (25x12x6.5 mm)

New junction operating temperature can be calculated with same assumed temperature values and with the chosen heatsink as follows: